

Regional Patterns of Alcohol-Specific Mortality in the United States

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Abstract

Regional patterns of health are usually determined based on areas defined by aggregations of states. A major limitation of this approach is that the regions are defined by state boundaries. Regional characteristics based on factors such as historical settlement patterns, economic activity, housing patterns, and ethnicity may not conform to state boundaries. Regional health patterns may be obscured by the artificial nature of regions defined by state boundaries. Geographic information systems (GIS) provide the capability to develop more sophisticated definitions of regions. This study examines regional patterns of alcohol-specific mortality based on complex definitions of regions not limited by state boundaries. Boundaries for 12 US regions defined by a large number of cultural factors were digitized. The digitized regional boundaries were overlaid onto all counties in the US. Counties split by regional boundaries were assigned to the region that contained the greatest amount of the area for that county. The alcohol mortality data for each county are provided by the Alcohol Epidemiologic Data System of the National Institute on Alcohol Abuse and Alcoholism. This study utilized mortality data that explicitly mention alcohol as a cause of death. Examples of alcohol-specific mortality include alcoholic cirrhosis, alcohol dependence syndrome, and alcoholic cardiomyopathy. Age-adjusted mortality rates were used. Alcohol-specific mortality was used to avoid confounding based on regional differences in the attributable fraction of alcohol-related diseases. Alcohol-specific mortality tended to be higher in the Pacific Southwest, Interior Southwest, and South. The rate in the South decreased substantially when mortality was adjusted for factors such as race and income. The Central Midwest had notably lower rates of alcohol-specific mortality. The study found significant differences in alcohol-specific mortality between regions of the United States. Regional patterns provide insight into the relationship between cultural factors, alcohol use, and alcohol-specific mortality.

Keywords: alcohol, mortality, regions

Introduction

Large areas of relative societal homogeneity are defined as cultural regions. The population of the United States is not an undifferentiated mass that is evenly distributed across the landscape. An examination of regions in the United States can provide an improved understanding of health needs and problems. Unfortunately, most regional analyses of health issues are based on aggregations of states or census statistical areas. These approaches are limited because the regions are based on state or other political boundaries, and the regions lack a strong theoretical foundation. Regional health

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patterns may be obscured by the artificial nature of the regions. Post hoc regional analyses of health data based on sub-state areas (e.g., counties, metropolitan areas) lack scientific rigor and are subject to idiosyncratic interpretations.

A geographic information system (GIS) can facilitate the utilization of more sophisticated definitions of regions that are not limited to existing political boundaries. Theoretically derived definitions of cultural regions can then be merged with public health data for analysis. Gastil (1) integrated information on historical settlement patterns, religion, economic activity, education, crime, and other factors to define cultural regions in the United States. His regional model is based on both historical and current information, which provides a stronger theoretical basis for the regions than is possible if the regions were based solely on either historical or current characteristics.

This study examines regional patterns of alcohol-specific mortality to provide an improved understanding of the variation of alcohol problems. Gastil's complexly defined regions are used to avoid problems with limited definitions and post hoc interpretations. The study is an extension of previous research on alcohol use and problems that indicates strong cultural influences on drinking (2,3), and regional differences in alcohol availability, consumption patterns, and problems (4,5).

Methods

The data used in the study were extracted from the 1990 US Census (6) and the 1986–1990 county level alcohol-related mortality tables published by the National Institute on Alcohol Abuse and Alcoholism (NIAAA) (7). The NIAAA obtained the alcohol-related mortality data from the National Center for Health Statistics. The mortality data are based on five years of data to provide a stable estimate, especially for areas with limited total population. The age-adjusted mortality rate was calculated by dividing the number of deaths by the total population for that county and multiplying it by 100,000. For the age-adjusted rates, the number of alcohol-related deaths for each county was standardized by the county's reference age distribution to better illustrate the influence of factors other than age.

For this analysis, only the rates for causes of deaths explicitly mentioning alcohol were used to avoid confounding based on regional differences in the attributable fraction of alcohol-related diseases. Alcohol-explicit mortality includes 12 causes of death such as alcoholic psychosis, alcohol poisoning, alcohol dependence syndrome, and alcoholic cirrhosis of the liver. The census variables used in the study are total population, number of persons over 65 years of age, median household income, number of persons below the poverty line, number of males, number of blacks, and number of Hispanics. Percentages were calculated for age, poverty, male, black, and Hispanic.

The county boundaries for the continental United States were purchased as an ARC/INFO polygon coverage in unprojected geographic coordinates. The 12 regional boundaries were digitized from Gastil's *Cultural Regions of the United States* (1) and then projected into decimal degrees so that they could be overlaid successfully with the county boundaries. The regions were then overlaid with the counties so that each county obtained at least one regional identifier. For those counties that were divided by a regional boundary, the union allowed comparison of the amount of a county's land area that fell within each region, and the county was assigned to the region containing the most area.

The map displays were categorized by minimizing the sum of the variance within each grouping—a “natural breaks” method using Jenk’s optimization. For the total population regional mortality map, the mean in each region was calculated by summing the population and number of age-adjusted cases for all counties assigned to that region, then dividing the total number of cases by the total population and multiplying by 100,000. Adjusted regional means were the estimated marginal means derived from an analysis of variance (ANOVA) of all the counties, using mortality rates as the dependent variable, region as the categorical factor, and four covariates (independent variables): percent over 65, median household income, percent male, and percent black.

Results

The raw alcohol mortality rates for the US counties are shown in Figure 1. Figure 1 also shows the boundaries of the cultural regions used in the study. Differences in the total geographic area of each county and in the number of counties in various regions makes it difficult to interpret the county-level data. Figure 2 shows the mean alcohol mortality rates for the various cultural regions. The rates shown in Figure 2 are based on total age-adjusted alcohol-explicit deaths and total population for each region. An ANOVA based on the counties assigned to each region indicated highly statistically significant differences between regions ($F=28.63$; $p<0.0001$). The visual impact of Figure 2 is striking, especially compared with Figure 1. Regional differences are readily apparent. Interpretation of the mortality rates shown in Figure 2 and Table 1 indicates that the Pacific Northwest, Pacific Southwest, Interior Southwest, New York metro area, and South have the highest mortality rates. The Central Midwest has notably lower alcohol mortality.

ANOVA with covariates was used to calculate adjusted means for the cultural regions. Factors such as race, age, income, and gender are known to be related to alcohol use and mortality (8). In addition, these factors also are related to cultural practices such as religion and economic activity. Figure 3 and Table 1 show the means adjusted for these factors. Age (percent over 65), race (percent black), gender (percent male), and median household income were all significant in the ANOVA. The two most influential covariates in the analysis are race and income. Race (percent black) is positively associated with alcohol mortality, while income is inversely associated with alcohol mortality. Note that additional analyses substituted percent Hispanic and percent in poverty for percent black and mean income without substantive differences in the results.

The adjusted means shown in Figure 3 and Table 1 still indicate significant and substantial differences between cultural regions. Regions high in alcohol mortality include the Pacific Northwest, Pacific Southwest, Interior Southwest, Rocky Mountain, and New York metro area. The main difference between Figures 2 and 3 is the lower adjusted mortality rate for the South. This suggests that black population and lower income population in the South accounts for a substantial portion of the mortality in this region.

Discussion

The results of this regional analysis of alcohol-explicit mortality show substantial differences between regions in the continental United States. The pattern changes when

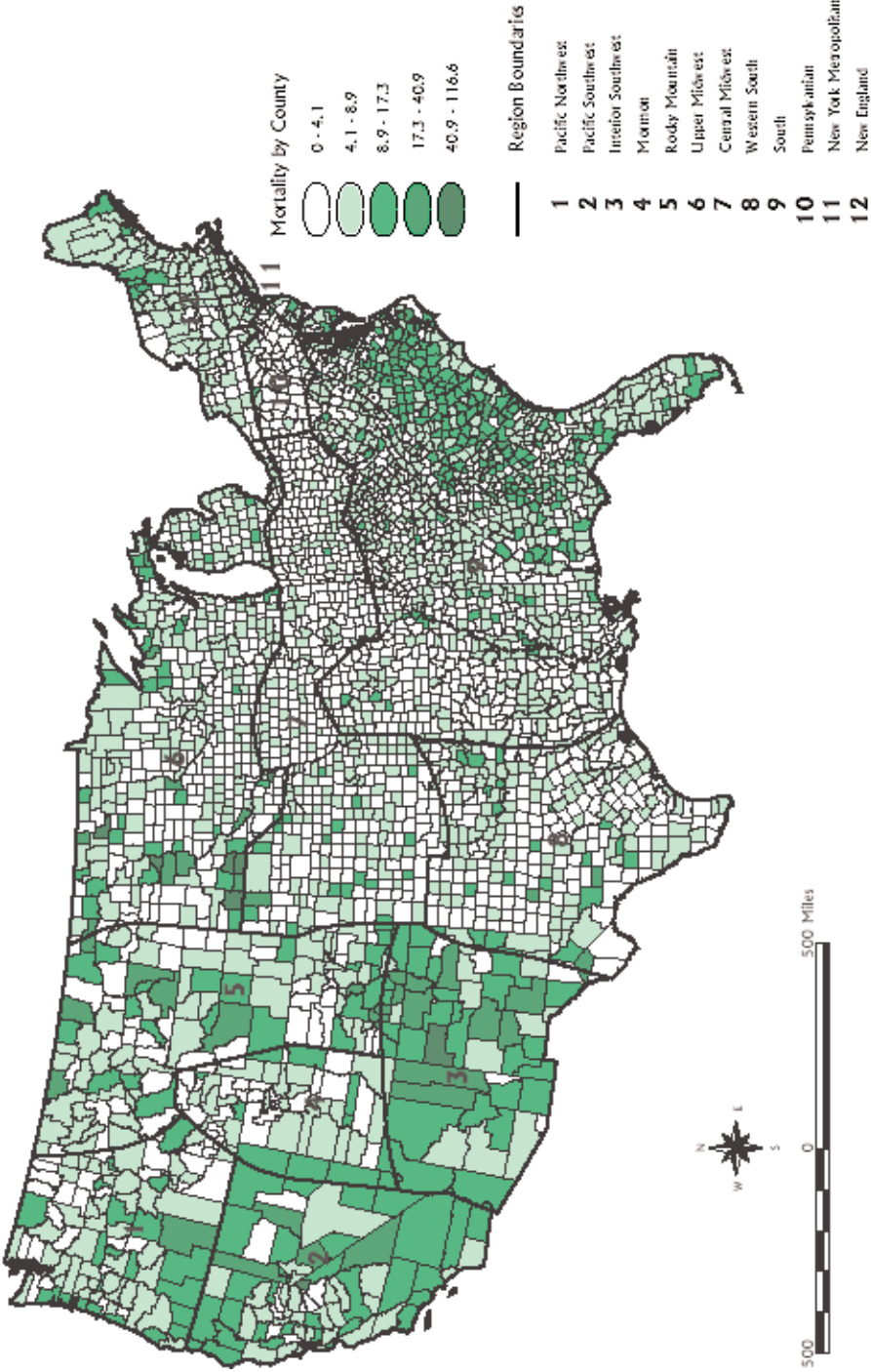


Figure 1 Cultural regions and alcohol-explicit mortality.

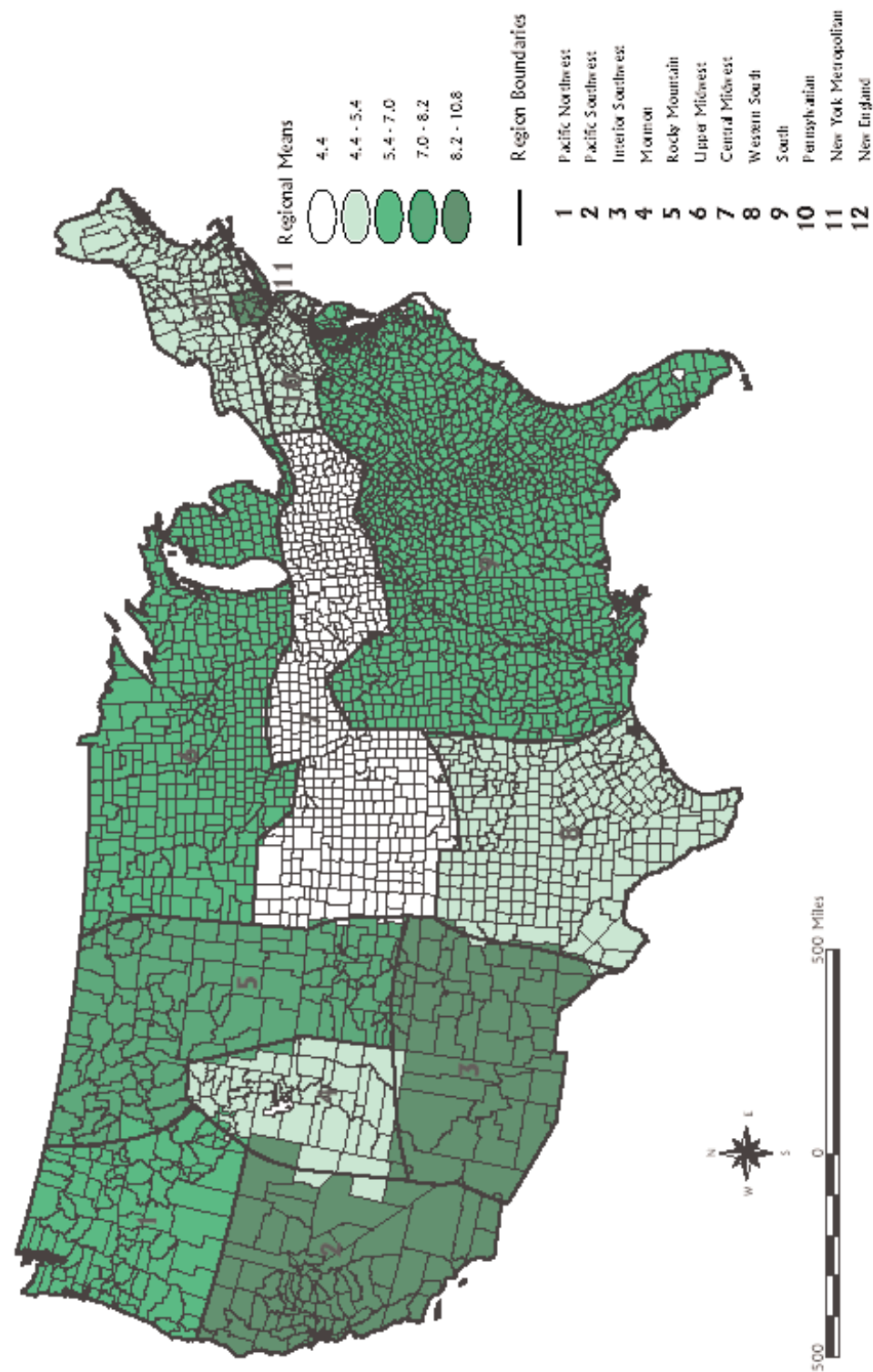


Figure 2 Regional means of alcohol-explicit mortality.

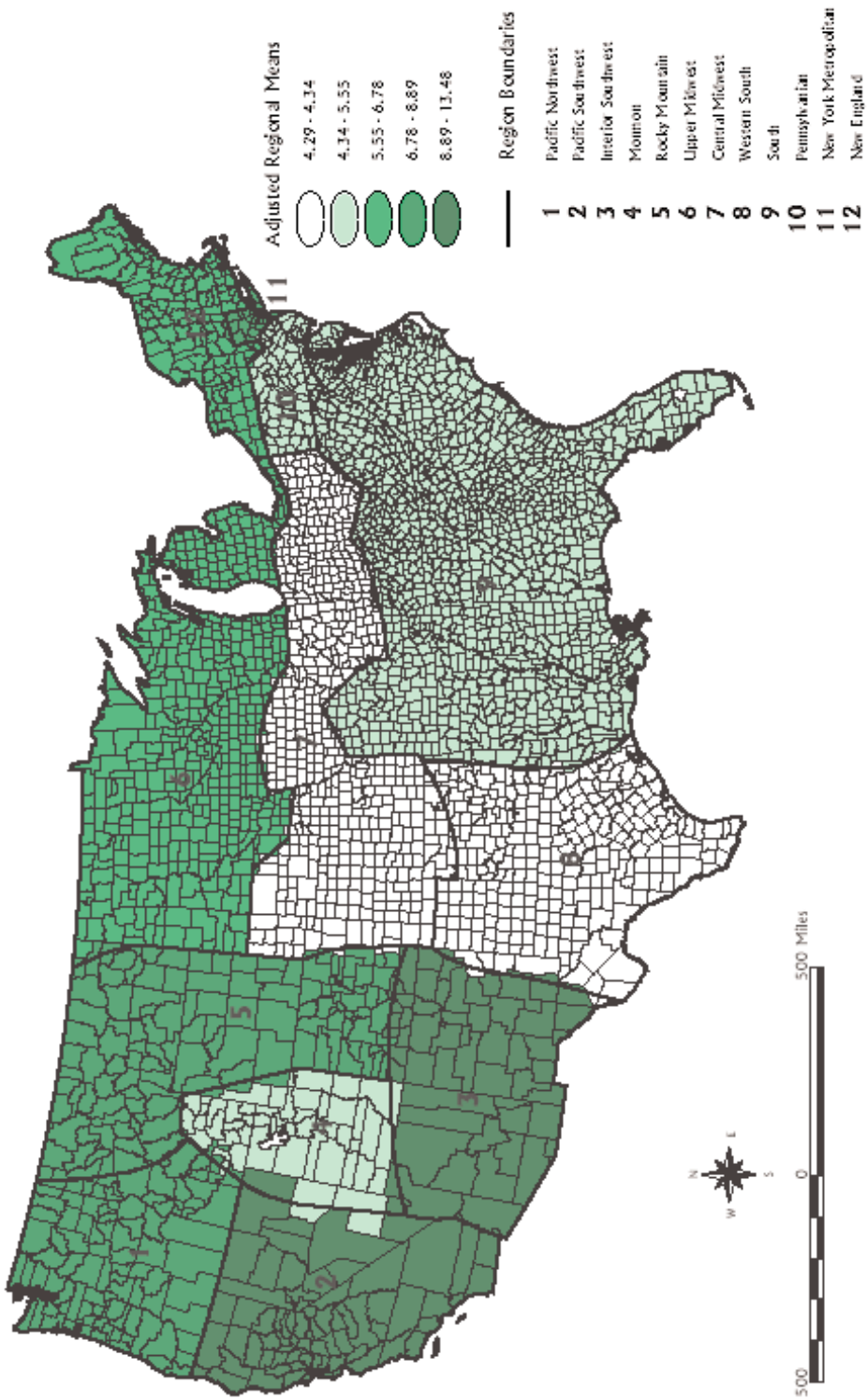


Figure 3 Adjusted regional means of alcohol-explicit mortality.

Table 1 Alcohol-Explicit Mortality Rate (per 100,000) by Region, United States

Region	Population Mortality Rate	Adjusted Mortality Rate	Adjusted Mortality (95% CI)	
			Lower	Upper
Pacific NW	7.0	7.5	6.5	8.6
Pacific SW	10.8	11.5	10.3	12.7
Interior SW	10.5	13.5	12.1	14.9
Mormon	5.1	5.5	4.1	6.9
Rocky Mt	8.2	8.0	7.1	8.9
Upper Midwest	7.0	6.8	6.3	7.3
Central Midwest	4.4	4.3	3.9	4.8
Western South	4.8	4.3	3.7	4.9
South	7.0	4.9	4.6	5.2
Pennsylvania	4.8	4.8	3.7	6.0
New York Metro	9.9	8.9	6.7	11.1
New England	5.4	6.5	5.6	7.4

covariates are controlled for, but the differences between regions remain quite notable. Clearly, the use of GIS to facilitate the regional analysis of public health data provides additional understanding and insight into public health issues, such as alcohol-related mortality.

The analysis provided evidence that alcohol mortality is particularly high in the western United States, outside of the Mormon region. These areas may require additional alcohol-focused interventions to lower the mortality. The New York metro area also appears to be in need of additional alcohol-focused public health interventions. Also notable, the initially high mortality rate in the South is explained by culturally related factors (i.e., percent black, median household income). This finding suggests that alcohol prevention and treatment efforts in the South should be targeted toward lower income populations and African Americans.

This study provides strong support for continued research on regional patterns of alcohol-related mortality. The identification of additional factors that explain regional differences may lead to further insights for interventions. Additional forms of alcohol-related mortality (e.g., specific types, attributable fractions, total alcohol mortality) should also be examined in future regional analyses.

Acknowledgments

This research was supported by grant P50 AA09802 from the National Institutes of Health, National Institute on Alcohol Abuse and Alcoholism.

References

1. Gastil RD. 1975. *Cultural regions of the United States*. Seattle: University of Washington Press.
2. McAndrew C, Edgerton R. 1969. *Drunken comportment*. Chicago: Aldine.

3. Kitano HHL, Chi I, Law CK, Lubben J, Rhee S-Y. 1988. Alcohol consumption of Japanese in Japan, Hawaii, and California. In: *Cultural influences and drinking patterns: A focus on hispanic and Japanese populations*. Research Monograph #19, US Department of Health and Human Services. 99–133.
4. Gruenewald P, Ponicki W. 1995. The relationship of alcohol sales to cirrhosis mortality. *Journal of Studies on Alcohol* 56:635–41.
5. Hilton ME. 1988. Regional diversity in United States drinking practices. *British Journal of Addiction* 83:519–32.
6. US Census Bureau. 1996. CensusCD, version 1.1. East Brunswick, NJ: Geolytics, Inc.
7. National Institute on Alcohol Abuse and Alcoholism (NIAAA). 1994. *County alcohol problem indicators, 1986–1990*. Rockville, MD: NIAAA. NIH Publication 94-3747.
8. NIAAA. 1997. *Ninth special report to Congress on alcohol and health*. Rockville, MD: US Dept. of Health and Human Services. NIH Publication 97-4017.